

WHAT IS CLAIMED IS:

1 1. A method for downloading resources, each having a  
2 size, from a source to an intermediate storage facility,  
3 having a finite storage capacity, the method comprising:

4 a) accepting at least one user-based factor;

5 b) accepting at least one resource-based factor;

6 and

7 c) maximizing an expected value of downloaded  
8 resources.

1 2. The method of claim 1 wherein the at least one  
2 user-based factor includes probabilities that a user  
3 belongs to various user type classes.

1 3. The method of claim 2 further comprising determining  
2 the probabilities that a user belongs to various user  
3 type classes.

1 4. The method of claim 3 wherein the probabilities that  
2 a user belongs to various user type classes are  
3 determined based on evidence using a Bayesian network.

1 5. The method of claim 2 wherein the at least one  
2 resource-based factor includes probabilities that users  
3 of the various user type classes will use the resource at  
4 least once.

1 6. The method of claim 1 wherein the at least one  
2 resource-based factor includes probabilities that users  
3 of the various user type classes will use the resource at  
4 least once.

1 7. The method of claim 2 wherein the at least one  
2 resource-based factor is a probability that the resource  
3 will be used at least once and is based on a sum, over  
4 all user type classes, of a product of (a) a probability  
5 that the resource is used at least once, given that an  
6 application to which the resource belongs is used at  
7 least once, by a user of the user type class, a  
8 probability that the application to which the resource  
9 belongs is used at least once by a user of the user type  
10 class, and (c) a probability that the user belongs to the  
11 user type class.

1 8. The method of claim 1 wherein the at least one  
2 resource-based factor includes an association of each of  
3 the resources to at least one application class.

1 9. The method of claim 8 wherein the at least one  
2 resource-based factor includes an indication, for each of  
3 the resources, of whether the resource is a core  
4 component or an optional component of the application  
5 class with which it is associated.

1 10. The method of claim 1 wherein the act of maximizing  
2 an expected value of downloaded resources includes

3 maximizing an expected value density of downloaded  
4 resources.

1 11. The method of claim 1 wherein the act of maximizing  
2 an expected value of downloaded resources includes  
3 minimizing an expected cost of not having a needed  
4 resource.

1 12. The method of claim 11 wherein the expected cost of  
2 not having a needed resource is based on one of  
3 enhancement rates of the resources and value densities of  
4 the resources.

1 13. The method of claim 12 wherein the enhancement rate  
2 of a resource is based on the size of the resource, a  
3 probability of that resource being used at least once,  
4 and a cost of later downloading the resource.

1 14. The method of claim 12 wherein the value density of  
2 a resource is based on the size of the resource and the  
3 probability that the resource will be used at least once.

1 15. An apparatus for downloading resources, each having  
2 a size, from a source to an intermediate storage  
3 facility, having a finite storage capacity, the apparatus  
4 comprising:

- 5 a) a storage device for storing at least one  
6 user-based factor and at least one resource-based  
7 factor; and

8           b) means for maximizing an expected value of  
9           downloaded resources.

1       16. A storage medium having machine executable  
2       instructions which, when executed by a machine, effect  
3       acts of:

- 4           a) accepting at least one user-based factor;  
5           b) accepting at least one resource-based factor;  
6           and  
7           c) maximizing an expected value of downloaded  
8           resources.

1       17. A method for installing software components, each  
2       having a size, from a source to an intermediate storage  
3       facility, having a finite storage capacity, the method  
4       comprising:

- 5           a) accepting at least one user-based factor;  
6           b) accepting at least one component-based factor;  
7           and  
8           c) maximizing an expected value of downloaded  
9           software components.

1       18. The method of claim 17 wherein the at least one  
2       user-based factor includes probabilities that a user is  
3       member of various user type classes.

1       19. The method of claim 17 wherein the at least one  
2       component-based factor includes an association of each of

3 the software components to one of a plurality of  
4 application classes.

1 20. The method of claim 19 wherein the at least one  
2 component-based factor further includes an indication,  
3 for each of the software components, of whether the  
4 software component is a core component or an optional  
5 component of the application class with which it is  
6 associated.

1 21. The method of claim 20 wherein the at least one  
2 component-based factor further includes probabilities  
3 that each of the software components will be used at  
4 least once by users of various user type classes.

1 22. A method for distributing resources, each having a  
2 size, among at least two storage facilities, each of the  
3 storage facilities having a finite capacity and a  
4 request-to-receive latency, the method:

- 5 a) accepting at least one user-based factor;  
6 b) accepting at least one resource-based factor;  
7 c) accepting at least one storage facility-based  
8 factor; and  
9 d) minimizing total expected latencies to request  
10 and receive resources.

1 23. The method of claim 22 wherein the at least one  
2 user-based factor includes probabilities that a user  
3 belongs to various user type classes.

1 24. The method of claim 23 further comprising  
2 determining the probabilities that a user belongs to  
3 various user type classes.

1 25. The method of claim 24 wherein the probabilities  
2 that a user belongs to various user type classes are  
3 determined based on evidence using a Bayesian network.

1 26. The method of claim 22 wherein the at least one  
2 resource-based factor includes frequencies at which users  
3 of the various user type classes will use each of the  
4 resources.

1 27. The method of claim 26 wherein the at least one  
2 storage facility-based factor includes an available  
3 capacity of each of the two storage facilities and a  
4 relative request-to-receive latency of each of the two  
5 storage facilities.

1 28. The method of claim 27 wherein the total expected  
2 latencies is a function of the frequencies at which users  
3 of the various user type classes will use each of the  
4 resources, and a difference between the relative  
5 request-to-receive latencies of the two storage  
6 facilities.

1 29. The method of claim 22 wherein the at least one  
2 storage facility-based factor includes an available  
3 capacity of each of the two storage facilities and a

4 relative request-to-receive latency of each of the two  
5 storage facilities.

1 30. The method of claim 22 wherein the total expected  
2 latencies to request and receive resources is minimized  
3 based on value densities of the resources.

1 31. The method of claim 30 wherein the value densities  
2 of the resources are based on the frequency of use of the  
3 resources and a difference in request to receive  
4 latencies between the at least two storage facilities.

1 32. A method for distributing resources, each having a  
2 size, among at least two storage facilities, each of the  
3 storage facilities having a finite available capacity,  
4 the method comprising:

- 5 a) determining, for each resource, a change in  
6 value of storing the resource on a first storage  
7 facility versus storing the resource on a second  
8 storage facility;  
9 b) determining, for each resource, a change in cost  
10 of storing the resource on the first storage  
11 facility versus storing the resource on the second  
12 storage facility;  
13 c) determining, for each resource, a value density  
14 based on the change in value determined in act (a)  
15 and the change in cost determined in act (b); and

16 d) maximizing a total value density given a total  
17 size of resources being less than the finite  
18 available capacity of the first storage facility.

1 33. The method of claim 32 wherein the value of storing  
2 a resource on the first storage facility is a function of  
3 a perceived utility of such storage, per request for the  
4 resource, and a frequency of requests for the resource.

1 34. The method of claim 33 wherein the perceived utility  
2 of such storage, per request for the resource, is a  
3 function of a request-to-receive time delay.

1 35. The method of claim 34 wherein the  
2 request-to-receive time delay is a function of at least  
3 one of (i) a storage device read access time, (ii) a  
4 network speed, (iii) a network latency, and (iv) the size  
5 of the resource.

1 36. The method of claim 35 wherein the network speed is  
2 a function of a user configuration.

1 37. The method of claim 33 wherein the frequency of  
2 requests for the resource is a function of a user type  
3 class and a number of users belonging to the user type  
4 class.



1 38. The method of claim 32 wherein the cost of storing a  
2 resource on the first storage facility is a function of  
3 the resource size.

1 39. An apparatus for distributing resources, each having  
2 a size, among at least two storage facilities, each of  
3 the storage facilities having a finite capacity and a  
4 request-to-receive latency, the apparatus comprising:

- 5 a) a storage device for storing at least one  
6 user-based factor, at least one resource-based  
7 factor, and at least one storage facility-based  
8 factor; and  
9 b) means for minimizing total expected latencies to  
10 request and receive resources.

1 40. A storage medium having machine executable  
2 instructions which, when executed by a machine, effect  
3 acts of:

- 4 a) accepting at least one user-based factor;  
5 b) accepting at least one resource-based factor;  
6 c) accepting at least one storage facility-based  
7 factor; and  
8 d) minimizing total expected latencies to request  
9 and receive resources.

1 41. A method for determining whether or not to change  
2 the storage capacity of an intermediate storage facility,  
3 the method comprising:

- a) determining a change in value associated with the change;
- b) determining a change in cost associated with the change; and
- c) determining whether or not to effect the change in the storage capacity of the intermediate storage facility based on the change in value and the change in cost.

42. The method of claim 41 wherein the units of value and cost are the same, and wherein it is determined to effect the change when the difference between value and cost is positive.

43. The method of claim 41 wherein it is determined to effect the change when a ratio of value to cost is greater than one.

44. The method of claim 1 wherein the at least one user-based factor is a function of a time offline until the intermediate storage facility is reconnected with the source.

45. The method of claim 44 wherein the time offline is a probability distribution considering at least one of (i) resource context, (ii) a user type class, and (iii) a recent usage pattern.